US Army Corps
of Engineers

SITE MANAGEMENT
AND
MONITORING PLAN

FOR THE

MOREHEAD CITY
OCEAN DREDGED MATERIAL DISPOSAL SITE

OCTOBER 1997

The following Site Management Plan for the Morehead City ODMDS has been developed and agreed to pursuant to the Water Resources Development Act Amendments of 1992 (WRDA 92) to the Marine Protection, Research, and Sanctuaries Act of 1972 for the management and monitoring of ocean disposal activities, as resources allow, by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers.

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This plan is effective from date of signature for a period not to exceed 10 years. The plan shall be reviewed and revised more frequently if site use and conditions at site indicate a need for revision.

SITE MANAGEMENT AND MONITORING PLAN
FOR THE
MOREHEAD CITY OCEAN DREDGED MATERIAL DISPOSAL SITE (ODMDS)
October 1997

INTRODUCTION

Under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972, it is the responsibility of the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (CE) to monitor and manage ocean dredged material disposal sites (ODMDS) to ensure that ocean dredged material disposal activities will not unreasonably degrade the marine environment or endanger human health or economic potentialities. The MPRSA, the Water Resources Development Act (WRDA) of 1992, and a Memorandum of Agreement between the EPA and the CE require the development of a site management and monitoring plan (SMMP) to specifically address the disposal of dredged material at the Morehead City ODMDS. Following an opportunity for public review and comment, the SMMP shall be a requirement for all dredged material disposal activities at the site. **All Section 103 (MPRSA) ocean disposal permits or evaluations shall be conditioned as necessary to ensure consistency with the SMMP.**

This SMMP has been prepared in accordance with Guidance Document for Development of Site Management Plans for Ocean Dredged Material Disposal Sites dated February 1996, which was prepared by the EPA and the CE. This document provides a framework for the development of site monitoring and management plans required by MPRSA and WRDA. The SMMP may be modified if it is determined that such changes are warranted, as a result of information obtained during the monitoring process. The SMMP shall be reviewed and revised at least every 10 years.

SCOPE OF THE SMMP

The ODMDS management involves a broad range of activities including regulating the times, the quantity, and the physical/chemical characteristics of dredged materials dumped at the site. The ODMDS management involves establishing disposal controls, conditions and requirements to avoid and minimize potential impacts to the marine environment. Finally, the ODMDS management involves monitoring the site environs to verify that unanticipated or significant adverse effects are not occurring from past or continued use of the site and that permit conditions are met.

The MPRSA, as amended by WRDA 1992, provides that the SMMP shall include but not be limited to:

- A baseline assessment of conditions at the site;
- A program for monitoring the site;
- Special management conditions or practices to be implemented at each site that are necessary for the protection of the environment;
- Consideration of the quantity and physical/chemical characteristics of dredged materials to be disposed of at the site;
- Consideration of the anticipated use of the site over the long term; and
- A schedule for review and revision of the plan.

OBJECTIVES OF SITE MANAGEMENT

There are three primary objectives in the management of the Morehead City ODMDS:

- Protection of the marine environment, living resources, and human health and welfare;
- Documentation of disposal activities at the ODMDS and provision of information which is useful in managing the dredged material disposal activities; and
- Provide for beneficial use of dredged material whenever practical.

The objective of the SMMP is to provide guidelines in making management decisions necessary to fulfill mandated responsibilities to protect the marine environment as discussed previously. Risk-free decision making is an impossible goal, however, an appropriate SMMP can narrow the uncertainty.

MOREHEAD CITY ODMDS

The Morehead City ODMDS (figures 1 and 2) was designated by EPA pursuant to Section 102(c) of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, as suitable for the ocean disposal of dredged material. The final rule was promulgated by EPA on 14 August 1987 (F.R. Vol 52 No. 157), effective 14 September 1987. The boundary coordinates for the Morehead City ODMDS are:

(Assumed to be NAD 27 Geographic)	(NAD 83 State Plane - Feet)
34^0 38'30" N 76^0 45'00" W	N 332180 E 2676711
34^0 38'30" N 76^0 41'42" W	N 332560 E 2693251
34^0 38'09" N 76^0 41'00" W	N 330519 E 2696808
34^0 36'00" N 76^0 41'00" W	N 317482 E 2697112
34^0 36'00" N 76^0 45'00" W	N 315021 E 2677055

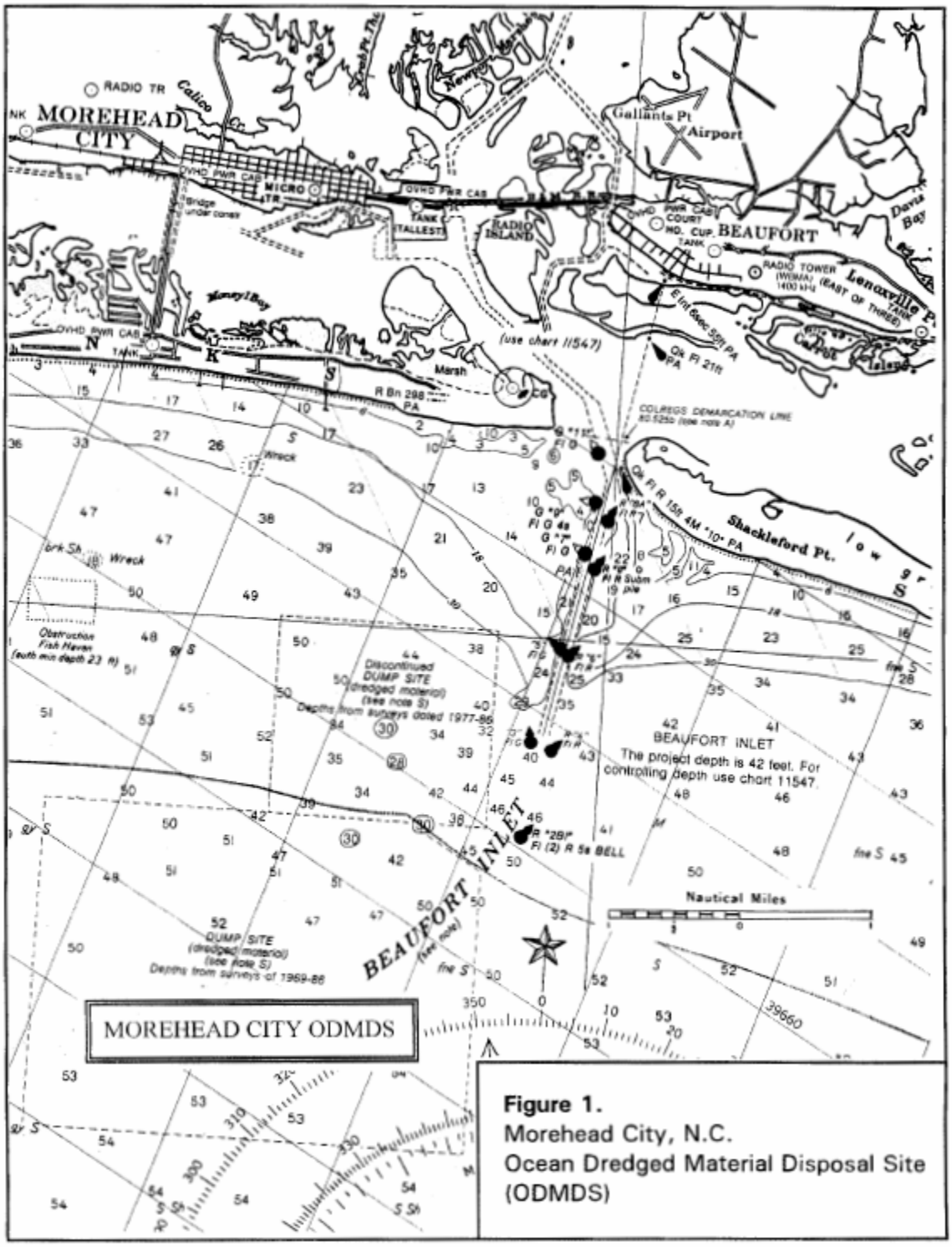


Figure 1.
Morehead City, N.C.
Ocean Dredged Material Disposal Site (ODMDS)

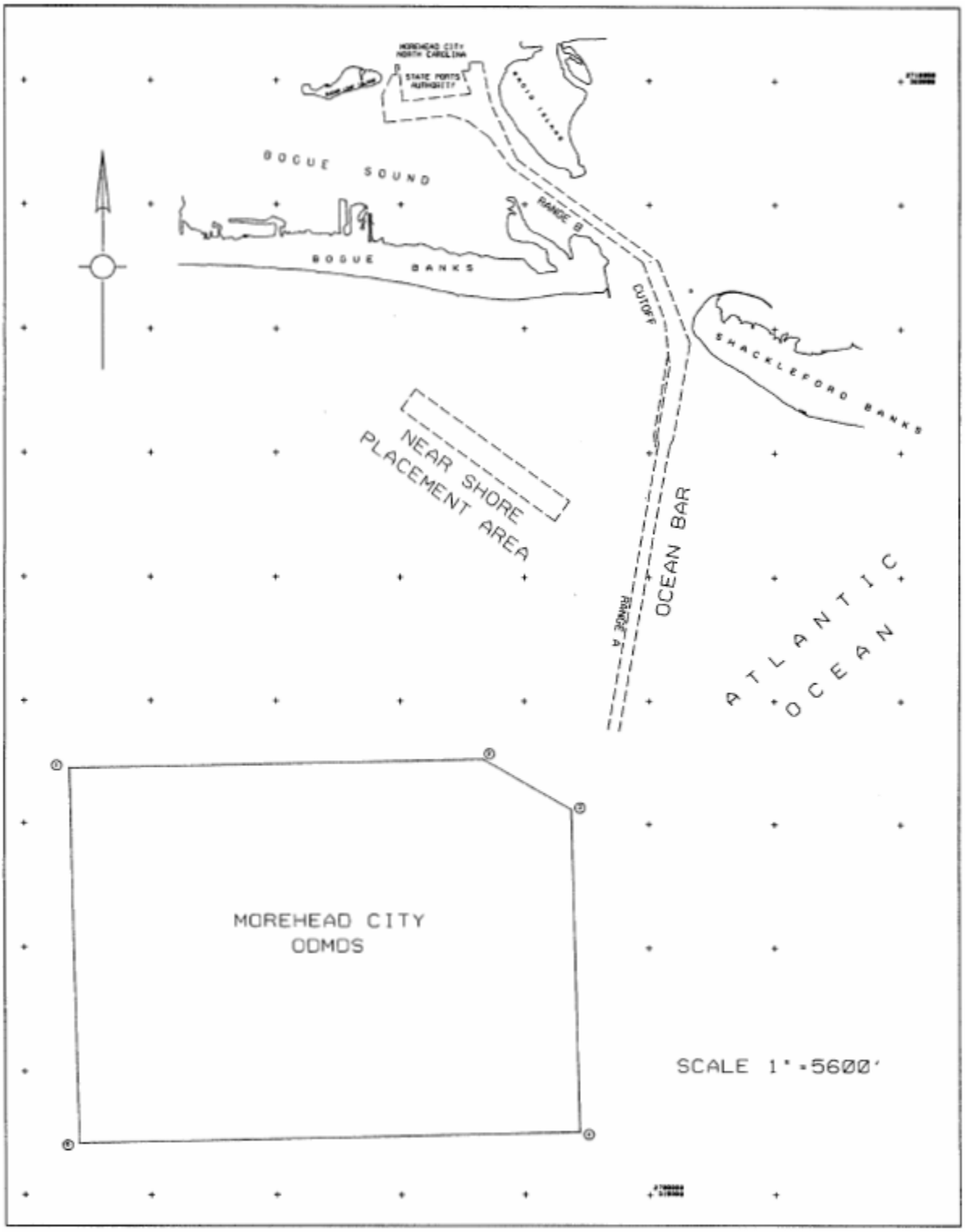


Figure 2. Morehead City ODMDS and nearshore placement area.

The site is located just beyond 3 nautical miles offshore and is just beyond the limits of the territorial sea. The Morehead City ODMDS has an area of about 8.0-square nautical miles. Depths within the ODMDS range from about -31 to -55 feet mean low water (m.l.w.) (based on a September and October 1995 bathymetric survey). The bathymetry is essentially flat except for mounds of dredged material in the northeast corner due to previous dredged material discharges and the influence of the Beaufort Inlet ebb tide delta in that same corner.

DISPOSAL HISTORY

Historical Use of the Morehead City ODMDS. Disposal of dredged materials in the ocean has been associated with the Morehead City Harbor Federal navigation project for many years. Federal dredging projects in Morehead City Harbor were begun in 1910. Continued use of the Morehead City navigation channel depends upon approximately annual maintenance dredging. No other private or permitted ocean dredged material disposal activities are known for the area.

The harbor improvements can be divided into dredging within inner harbor and Beaufort Inlet ocean bar channels. Dredging in the inner harbor areas has been performed with a hydraulic cutterhead dredge with dredged material disposal being upland or on the beach. The ocean bar channel dredging has been accomplished with a hopper dredge with disposal in the ocean. The ocean bar channels specifically include Range A, the Cutoff, and Range B (figure 2). In 1910, the Morehead City Harbor ocean bar channel was deepened to 20 feet at a width of 300 feet. Improvements to the channel were made in 1936 and 1978 when the ocean bar channel was deepened to 30 feet by 400 feet and 42 feet by 450 feet, respectively. In 1994, the bar channel was dredged to its present dimensions of 47 feet deep and 450 to 600 feet wide.

Since 1970, approximately 19.9 million cubic yards of dredged materials have been disposed of in the ocean off Beaufort Inlet (table 1 and figure 3). Since 1987 (the date of site designation), approximately 7.9 million cubic yards of dredged materials Morehead City Harbor Federal project channels have been placed within the Morehead City ODMDS. The 1987-1996 quantity can be divided into 6.2 million cubic yards of sediments dredged during channel maintenance and 1.7 million cubic yards of new work dredged material or sediments dredged from areas or depths not previously dredged. Between 1970 and 1996, the average annual volume of dredged material placed in the ocean has been about 0.7 million cubic yards. The maintenance volumes for 1995 and 1996, the years since the last channel modifications or improvements have been 0.82 and 0.66 million cubic yards, respectively. The 1996 dredging volume was reduced somewhat due to funding limitations. The 1995 and 1996 records are likely representative of current site use.

Nearshore Placement. In 1995 and 1996, sediments dredged during the maintenance of the Morehead City navigation channels and routinely placed in the Morehead City ODMDS were instead placed in a nearshore disposal area off Bogue Banks. The nearshore placement area lies approximately along or near the -25 foot m.l.w. contour (figure 4). This activity was regulated under the Clean Water Act of 1977. The purpose of the nearshore disposal was to "renourish" the ebb tide delta associated with Beaufort Inlet. The Inlet's ebb tide delta is believed to be deflating, e.g., losing sand from the system. Sand placed on the outer perimeter of the tidal delta would serve as a feeder mound allowing nourishment of the delta. In 1995, approximately 173,000 cubic yards were dredged and placed in the nearshore placement area while 642,000 cubic yards were dredged and placed in the Morehead City ODMDS. In 1996, approximately 657,000 cubic yards were dredged all of which were placed in the nearshore area. Monitoring of the movement of the nearshore placed sand, the benthic communities in the nearshore placement area, and the responses of the ebb tide delta and nearby shorelines is ongoing. The 1997 bathymetric surveys indicate that the -25 foot m.l.w. contour may be too deep for transport of the placed sand into the littoral system. Movement of the nearshore placement area further inshore (into shallower water) would affect the type of dredging equipment capable of performing the work and, thus, the project economics.

Table 1. Volume of dredged materials placed in the Atlantic Ocean off Beaufort Inlet (Morehead City), North Carolina.

	DREDGED MATERIAL QUANTITY - CUBIC YARDS		
YEAR	**MAINTENANCE**	**NEW WORK**	**TOTAL**
1970	1,191,558	0	1,191,558
1971	0	0	0
1972	268,967	0	268,967
1973	1,189,481	0	1,189,481
1974	885,136	0	885,136
1975	238,289	0	238,289
1976	265,082	0	265,082
1977	583,929	63,796	647,725
1978	96,133	1,364,084	1,460,217
1979*	0	1,608,131	1,608,131
1980	530,008	0	530,008
1981	824,052	0	824,052
1982	977,040	0	977,040
1983	848,933	0	848,033
1984	0	0	0
1985	583,181	0	583,181
1986	507,593	0	507,593
1987	543,555	0	543,555
1988	691,190	0	691,190
1989	539,192	0	539,192
1990	592,232	0	592,232
1991	831,637	0	831,637
1992	209,400	0	209,400
1993	628,200	0	628,200
1994	715,000	1,690,900	2,405,900
1995**	815,579	0	815,579
1996***	656,636	0	658632
1970-1995	15,212,003	4,726,911	19,940,010

Note: New Work - Dredging in areas or to depths not previously dredged.
Maintenance - Dredging to maintain previously established project conditions.

1979* - Maintenance likely included or reported in new work total.
1995** - A portion of this total placed in ODMDS and part placed in the Morehead City nearshore placement area. See **Nearshore Placement**.
1996*** - All of this total placed in nearshore placement area.

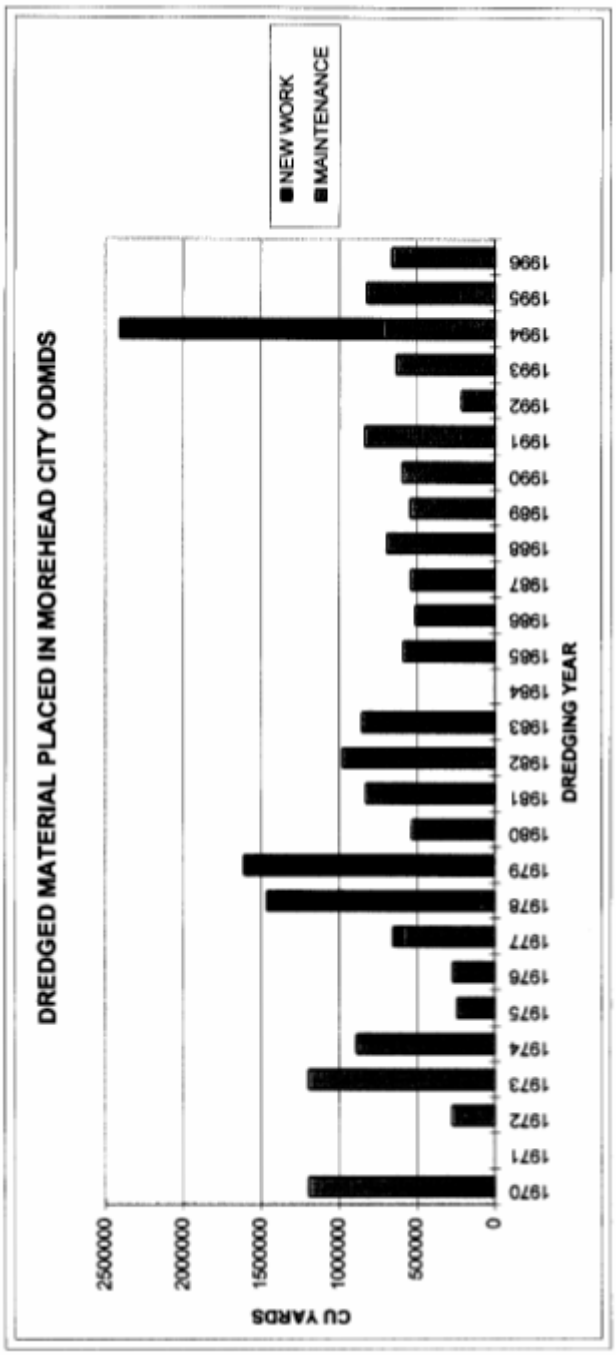
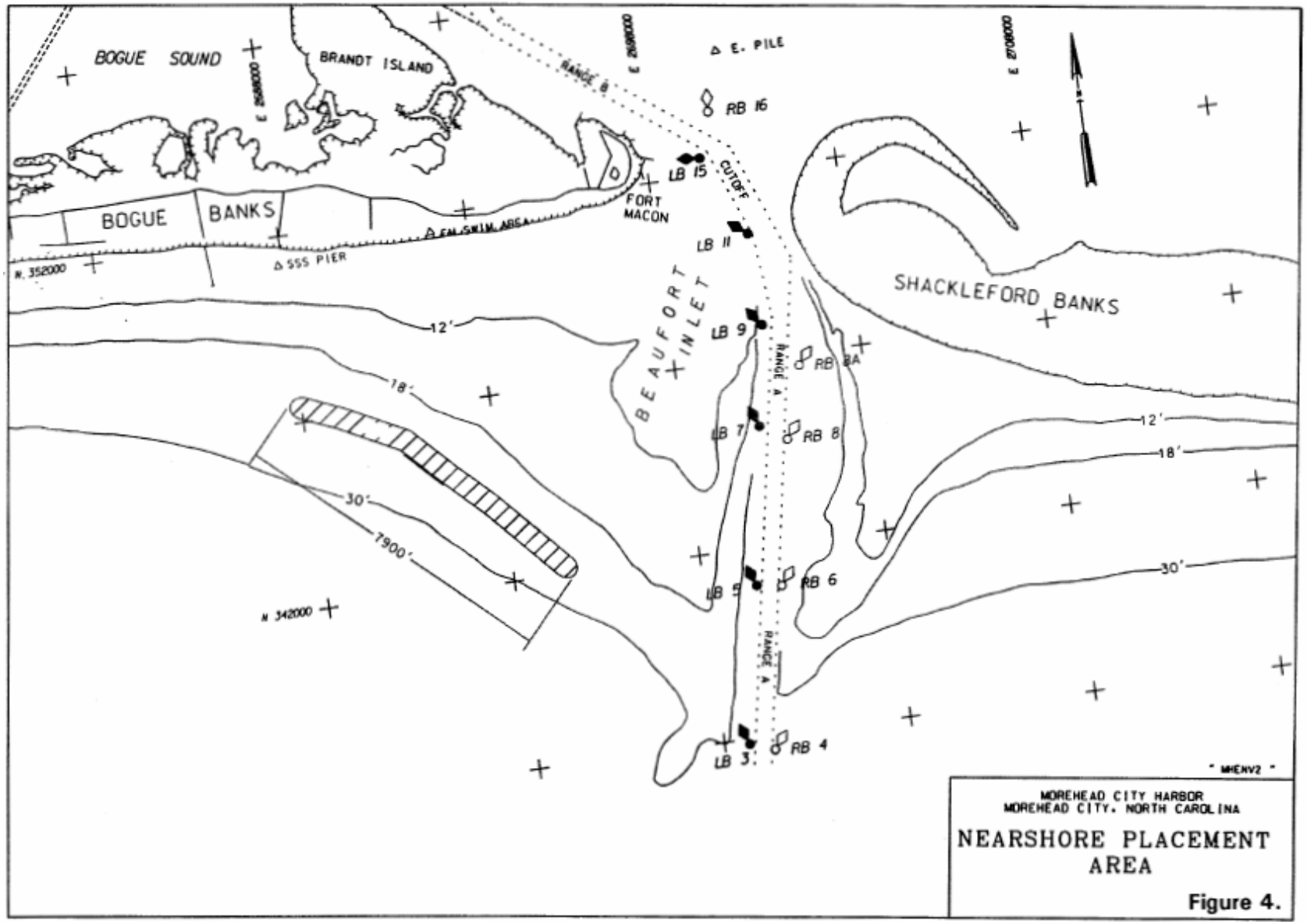


Figure 3. Volume of dredged material placed in Morehead City ODMDS, 1970 - 1996.


BOGUE SOUND
BRANDT ISLAND
BOGUE BANKS
E 280000
RANGE B
E. PILE
RB 16
LB 15
CUTOFF
FORT MACON
FM SWIM AREA
SSS PIER
N. 352000
LB 11
SHACKLEFORD BANKS
BEAUFORT INLET
LB 9
RB 8A
RANGE A
LB 7
RB 8
12'
18'
30'
1900'
N 342000
LB 5
RB 6
LB 3
RB 4
MHENV2
MOREHEAD CITY HARBOR
MOREHEAD CITY, NORTH CAROLINA
NEARSHORE PLACEMENT AREA
Figure 4.

Characteristics of Dredged Materials.

Maintenance Materials. The sediments dredged from the Morehead City Harbor navigation channels during maintenance of authorized project depths and transported to the Morehead City ODMDS have been predominantly fine-to-medium sands and shell fragments. These sediments meet the criteria established in EPA's Ocean Dumping Regulations and Criteria, 40 CFR Part 227.13(b)(1) for environmental acceptability without further testing. The sediment characteristics are affected by the small sediment load of the Newport River which terminates in the area and the dynamic nature of the Beaufort Inlet tidal currents and waves which further winnow small particles in the sediments. Tables 2 and 3 document grain size characteristics of Morehead City Harbor navigation channel maintenance sediments based on surface grabs (table 2) and borings (table 3).

Table 2. Grain size characteristics of Morehead City Harbor channel sediments. Samples were surface grabs of shoal material to be removed by maintenance dredging. Samples collected March 1979. See figure 5 for sample locations.

Station No.	%Gravel	%Sand	% Silt & Clay	Median Size mm
1	6.0	93.0	1.0	0.5
2	3.0	96.0	1.0	0.4
3	3.0	96.0	1.0	0.26
4	5.0	94.0	1.0	0.35
5	0.0	98.0	2.0	0.18
6	0.0	97.0	3.0	0.15

Note: Gravel - grain size larger than 5.0 mm.
Sand - grain size between 0.07 and 5.0 mm.
Silt & Clay - grain size smaller than 0.07 mm.

Source: USACE/ EPA, 1985.

New Work Sediments. Sediments dredged during channel deepening or other modifications (i.e., 1977-79 and 1994) have been predominantly sands but have contained scattered pockets of interbedded clays and silts as a result of changes in the environments of deposition over geologic time. However, those subsurface strata are substantially the same as the substrate in the ODMDS and have been isolated from historic sources of pollution and therefore do not require further testing (40 CFR 227.13 (b)(3)(i and ii). Table 3 summarizes subsurface investigations which characterize Morehead City Harbor sediments to the current project depth of 45 feet.

Table 3. Morehead City Harbor subsurface investigations. Station locations are shown on Figure 5. Samples collected by vibracore in October 1972.

				Material Designation				
Bore#	**Top of Hole***	**Sample#**	**Sample Depth***	**%Sand**	**%Silt/Clay**	**%>5 mm**	**Median Size mm**	**Maintenance/New Work**
12	30.5	2	35.6 - 36.0	99	1	0	0.19	Maintenance
13	35.5	1	36.0 - 36.3	95	1	4	0.3	Maintenance
14	40.2	1	41.5 - 41.8	2	98	0	0.001	New Work
15	37.5	2	40.5 - 40.9	98	2	0	0.15	New Work
		4	46.5 - 46.8	95	1	4	0.39	New Work
16	37.0	1	38.0 - 38.3	97	1	2	0.32	Maintenance
		3	42.0 - 42.5	97	3	0	0.15	New Work
17	35.5	2	40.0 - 40.3	94	1	5	0.15	New Work
18	37.0	1	38.0 - 38.3	97	3	0	0.16	Maintenance
		3	44.0 - 44.4	97	3	0	0.15	New Work
19	42.0	1	44.0 - 44.5	19	81	0	0.004	New Work
20	32.8	4	43.5 - 43.8	95	4	1	0.38	New Work
		5A	45.3 - 45.6	95	4	1	0.25	New Work
21	45.5	1	47.0 - 47.5	76	23	1	0.16	New Work
22	32.8	1	34.8 - 35.0	98	1	1	0.27	Maintenance
		3	43.5 - 43.6	93	7	0	0.08	New Work
23	27.6	1	28.4 - 28.6	99	1	0	0.5	Maintenance
24	42.0	1	44.0 - 44.5	92	1	7	0.65	New Work
25	34.0	2	39.5 - 40.0	92	1	7	0.5	Maintenance
		3	45.0 - 45.5	98	1	1	0.31	New Work
26	41.0	2	44.0 - 44.5	83	9	8	0.6	New Work
27	38.0	2	44.0 - 44.5	98	2	0	0.3	New Work
28	38.0	2	44.0 - 44.5	88	12	0	0.15	New Work
29	42.4	2A	47.6 - 47.9	89	4	7	0.5	New Work

NOTE: * top of hole and sample depth are feet below mean low water
Gravel - grain size larger than 5.0 mm
Sand - grain size between 0.07 and 5.0 mm
Silt and Clay - grain size smaller than 0.07 mm

Table 3 (continued). Morehead City Harbor subsurface investigations. Station locations are shown on Figure 5. Samples collected by vibracore in October 1972.

				Material Designation				
Bore#	**Top of Hole***	**Sample#**	**Sample Depth***	**%Sand**	**%Silt/Clay**	**%>5 mm**	**Median Size mm**	**Maintenance/New Work**
30	33.8	2	40.7 - 41.2	80	20	0	0.12	New Work
		3	41.9 - 42.2	62	24	14	0.16	New Work
		4	48.8 - 49.1	96	4	0	0.16	New Work
31	41.0	2	42.5 - 42.8	24	76	0	0.026	New Work
		3	48.0 - 48.5	80	14	6	0.19	New Work
32	38.7	2	44.7 - 45.0	98	2	0	0.20	New Work
		3	47.7 - 48.2	92	1	7	0.9	New Work
33	24.2	2	30.0 - 30.3	97	3	0	0.15	Maintenance
		3	33.2 - 33.5	98	2	0	0.15	Maintenance
		5	41.2 - 41.6	89	11	0	0.12	New Work
34	40.2	2	42.9 - 43.3	74	26	0	0.098	New Work
		3	48.5 - 48.9	95	4	1	0.25	New Work
35	25.6	2	33.2 - 33.6	89	11	0	0.15	Maintenance
		4	37.6 - 38.0	95	5	0	0.15	Maintenance
		5A	41.8 - 42.2	92	8	0	0.15	New Work
		5B	43.6 - 44.0	78	22	0	0.078	New Work
36	28.2	2	34.0 - 34.4	96	4	0	0.17	Maintenance
		4A	41.7 - 42.1	96	4	0	0.15	New Work
		4B	43.7 - 43.9	68	32	0	0.045	New Work
37	38.4	3	47.5 - 48.0	52	48	0	0.085	New Work
38	31.5	1	33.5 - 33.8	96	0	0	0.16	Maintenance
		4A	43.7 - 44.0	93	2	5	0.43	New Work
		4B	45.0 - 45.3	13	77	0	0.007	New Work
39	43.5	1	47.2 - 47.9	98	2	0	0.23	New Work

NOTE: (See notes on page 1 of this Table).

DREDGING DEPTHS

Project dimensions:	1979-94 Depth (feet)	1994-present Depth (feet)	Width (feet)
Ocean bar channel (Range A)	42	47	450
cutoff channel	40	45	600
Inner harbor channel (Range B)	40	45	varies

Actual depths in these areas would include an additional 2 feet of allowable dredging overdepth
Other project areas are not routinely ocean dumped

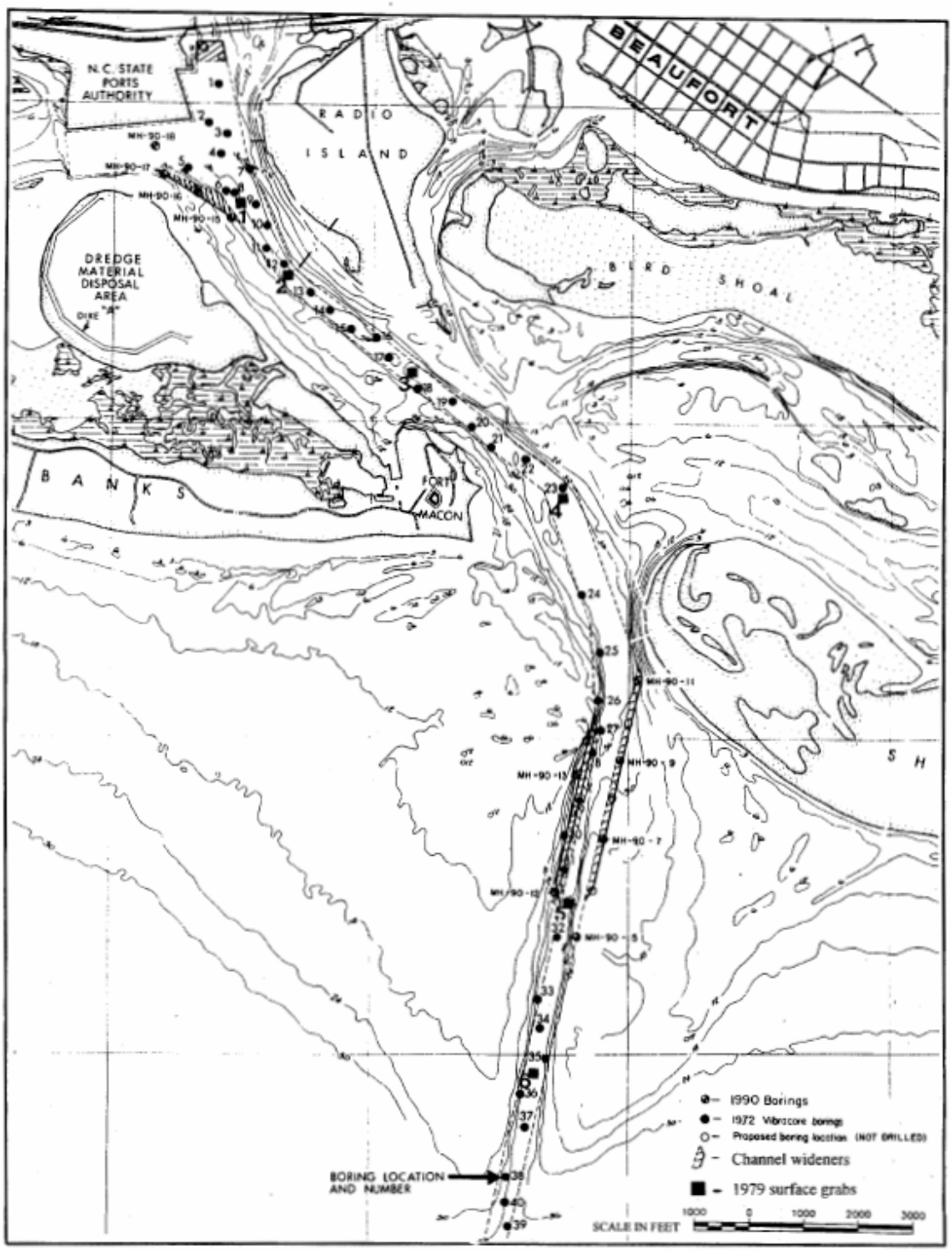


Figure 5. **Sediment sample locations.**

Disposal Methods. Disposal of dredged material at the Morehead City ODMDS has been accomplished by using hopper dredges. Hopper dredges are designed to hydraulically dredge sediments, load and retain solids in the hoppers, and then haul them to the disposal site where disposal is accomplished by dumping through doors in the bottom of the hoppers or through the split hull.

Management Concerns or Issues.

Nearshore Placement. As discussed previously, sediments dredged during the maintenance of the Morehead City navigation channels and routinely placed in the Morehead City ODMDS were instead placed in a nearshore disposal area off Bogue Banks during 1995 and 1996. The intention is to keep material within the active littoral system without dramatically increasing the amount of annual maintenance dredging in the channel or the cost of the maintenance dredging. The nearshore placement has been analyzed for its potential movement. Model simulations using depths of 20, 22, and 25 feet have indicated that placing the dredged material in shallow water increases activity of the material. Waves and currents flatten the material disposal mound and move it shoreward within the active littoral system. In the 20- and 22-foot depth simulations, a 6- to 7-foot disposal mound was found to have been moved shoreward and flattened over a period of 12 months by the projected waves and tidal currents of the area. However, a 10-foot high disposal mound in 25 feet of water did not move appreciably during the same period. Preliminary analyses of 1997 bathymetric surveys of the nearshore placement area seem to verify these simulations.

While placement of the dredged material in shallower water increases littoral system activity, it also increases concerns regarding hopper dredge operating conditions. A hopper dredge with a draft of nearly 20 feet or more is vulnerable to grounding in a nearshore placement operation as compared to the ODMDS, particularly if any ocean swell is present. Most of the material dredged during the 1995 Morehead City Harbor maintenance was placed in the ODMDS. This was due to operational limitations primarily imposed by the draft of the hopper dredge and ocean swell conditions. In 1996 a smaller, shallower draft, hopper dredge was used and material was successfully placed along the 25-foot contour. It is uncertain if routine hopper operations can place material further inshore than the 25-foot contour which seems to be necessary for including the material in the active littoral system.

In summary, nearshore placement may be an alternative to the future ODMDS placement of Morehead City Harbor dredged materials. However, if the intended benefits are not achieved, or if the activity is not operationally feasible then disposal within the Morehead City ODMDS may be the only available alternative for the ocean bar channel dredged materials. A determination of the need for placement of dredged material in the ODMDS must be documented in a MPRSA Section 103 evaluation and approved by the EPA, Region IV, prior to disposal and reevaluated in accordance with current

CE/EPA guidance at an interval not to exceed 3 years. As information regarding the utility of nearshore placement is developed, the MPRSA Section 103 evaluation should be updated specifically as it pertains to the need for continued placement of dredged material in the ODMDS.

Mounding. Bathymetric surveys have indicated that the sandy and coarse dredged materials historically placed within the Morehead City ODMDS have the potential to mound appreciably when specific areas are used repeatedly for disposal. For example, a mound with a peak sounding of -30.5 feet m.l.w. was surveyed in February 1992. The location of this mound was at the ODMDS corner nearest outer limit of the Morehead City Harbor channel. Such mounds may limit future use of those areas of the ODMDS and may pose an impairment to navigation including use by hopper dredges.

Dumps Outside the ODMDS. Since 1987, a small number of dredged material loads have been reported as placed outside the Morehead City ODMDS. Based on a review of recent dump records, there appear to be two main reasons for the misplaced materials, operator errors and equipment errors or limitations in the mechanical aspects of the dumping. Operator errors occur when a person, the equipment operator, does not correctly carry out the ocean disposal specifications. For example, the operator may not have the correct coordinates of the disposal area. Equipment errors occur when equipment malfunction or a misunderstanding of equipment limitations takes place. For example, the dump target is placed at the edge of the disposal area without adequate margins for mechanical or sea conditions and the dump vessel overshoots the dump area.

Navigation Channel Alignment. If the Morehead City Harbor navigation channel alignment is extended in a straight line and beyond the normal dredging limits, it overlaps a portion (southeast corner) of the Morehead City ODMDS. Disposal of dredged material in the channel alignment extension may pose an impairment to navigation.

OCEAN DREDGED MATERIAL SITE MANAGEMENT

All ocean disposal at the Morehead City ODMDS must be conducted in accordance with the Ocean Dumping Regulations and Criteria (40 CFR Parts 220-229), whether conducted as a permit activity or as a Federal activity. The following are Morehead City ODMDS management requirements and all permit or evaluations concurrences shall be conditioned to include these requirements.

Types of Dredged Materials To Be Disposed.

Evaluated Material. Only dredged materials which have been evaluated in accordance with EPA's Ocean Dumping Regulations and Criteria and found acceptable will be accepted for unrestricted disposal in the Morehead City ODMDS.

Guidance for evaluation of dredged materials under the MPRSA Section 103 program is provided in the Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual, February 1991 and the Regional Implementation Manual, Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Materials in Southeastern Atlantic and Gulf Coastal Waters, May 1993. The determination dredged material suitability for ocean disposal must be documented in a MPRSA Section 103 evaluation and approved by the EPA, Region IV, prior to disposal. Dredged materials will be reevaluated for suitability for ocean disposal in accordance with current CE/EPA guidance at an interval not to exceed 3 years. Reevaluation and testing procedures should be coordinated with the CE and the EPA prior to any sampling or testing.

Dredged Material Suitable for Beneficial Uses. Beneficial uses refers to the concept that dredged material can be disposed of in a way that is economically and environmentally acceptable and accrues natural resource benefits to society.

Beach-compatible dredged materials (sands) dredged from the ocean bar navigation channel should be placed on nearby beaches or within the active littoral system when it is economically feasible and environmentally acceptable to do so. Other beneficial uses of dredged materials, such as their use to enhance or develop fisheries resource features (reefs or berms) are also encouraged with appropriate environmental review.

Methods of Disposal. No specific disposal method is required for this site. Disposal may be by hopper dredge, dump scow, or by pipeline discharge. Dredged materials will be discharged within the ODMDS boundaries. The placement of dredged materials outside the ODMDS boundaries is not acceptable under MPRSA authorities. An approved ocean disposal verification plan must be implemented. Placement methods which prevent mounding of dredged materials from becoming an unacceptable navigation hazard will be used. Specific procedures which accomplish these goals are discussed under the **Specific Requirements** section which follows.

Disposal Quantities. Quantities of dredged materials placed within the ODMDS will be limited to those amounts that do not produce unacceptable adverse effects to human health and welfare and the marine environment or human uses of that environment (as defined in EPA's Ocean Dumping Regulations and Criteria). The disposal quantity management objective for the Morehead City ODMDS is to regulate disposal quantities such that depths in the disposal area following disposal do not interfere with navigation. The disposal depth limitation will be -35 feet m.l.w. Current average depths in the ODMDS are approximately -52 feet m.l.w.

Timing of Disposal. There are no seasonal restrictions to the placement of dredged material within the Morehead City ODMDS.

Disposal Buoy. A U.S. Coast Guard (USCG) Nun buoy (yellow "A") has been placed within the Morehead City ODMDS. This buoy's purpose is primarily to alert ships to the presence of the ODMDS. Accurate microwave line-of-sight or differential global positioning system (DGPS) is required for all disposal vessels. However, the disposal buoy is available as a backup point of reference if the disposal vessel positioning systems fail.

Specific Requirements.

Ocean Disposal Verification. The vessels used for dredge material disposal will be required to operate under an approved verification plan. The location and quantity of each disposal load placed within the Morehead City ODMDS must be maintained in a computerized data base. All exception loads (i.e., reported disposal out of the ODMDS boundaries or no location reported) will be documented and the disposal operator questioned to determine what occurred and the reason for the exception. The verification plan will include an automated system that will record the horizontal location and draft condition of the disposal vessel from the time it leaves the Morehead City Harbor channel (Beaufort Inlet channel) outbound until the vessel reenters the channel inbound. Vessel positioning as a minimum shall be either a microwave line-of-sight system or DGPS. Minimum required data for each load is as follows:

- Dredge or vessel name
- Sequential load number
- Date
- Time, vessel position, and draft in 1 minute intervals
  for the disposal cycle specified previously,
  positioning in North Carolina state plane coordinates,
  draft in feet
- Begin and end dump event times and positions
- Source of dredged material, i.e., reach name
- Volume of dredged material disposed

These data shall be available on a daily basis. No vessel shall leave for the disposal site without the ability to collect and record the ocean disposal verification data specified. The disposal positions reported shall be those of the disposal vessel itself (i.e., the scow not the tug).

In addition, a summary report of operations shall be provided to the CE and the EPA, Region IV, at the completion of the dredging/ocean disposal activity. Minimum required data to be included in the summary report is as follows:

- General Information
  - Project name
  - Location
  - Public notice or permit date
- Disposal Site Used
- Project Type - Either Federal or permitted
- Type of Work - New or maintenance work
- Method of Dredging and Disposal
- Disposal Dates - Range of disposal dates - start to finish
- Quantity of Dredged Material Disposed - in cubic yards
- Point of Contact for Disposal Activity

Disposal "Zones" Within the ODMDS. In order to manage site use, for example, maximize site capacity, reduce multiple user conflicts, facilitate monitoring and management, and reduce potential adverse impacts to the marine environment, the CE in consultation with the EPA will designate zones within the ODMDS for dredged materials from each specific ocean dumping activity. Site monitoring data will be used to adjust these zones relative to current site conditions. In order to maximize water depths for ships approaching the Morehead City Harbor channel, disposal zones will not be designated within 2,000 feet of the Morehead City Harbor navigation channel centerline and an extension of that centerline to a point beyond the ODMDS.

Control of Mounding. Dredged material disposal shall be conducted in a manner that water above the dumped material will have a minimum clearance of -35 feet m.l.w. In order to maximize ODMDS capacity and minimize mounding of material, the dumps shall be scattered throughout designated disposal zones and not placed repeatedly at one location. The disposal zones may be divided into a number of disposal cells or quadrants which will be sequentially used to ensure dispersal or spreading of the dredged material rather than mounding. A maximum lift or thickness of dredge material deposit allowable for each disposal event may be established to promote dispersal of material within the disposal zone. Depths at the time of disposal will be monitored to determine if adjustment of disposal methods is needed to prevent unacceptable mounding.

Emergency Dumps. If a Morehead City ODMDS user experiences an emergency situation which causes a dumping of dredged material outside of the ODMDS, the site user must notify the CE and the EPA, Region IV, in writing within 2 days of the emergency dump, the reason for the emergency, and the location of the dump. If, in the opinion of the EPA, Region IV, the misplaced dredged materials are a hazard to the marine environment and its uses, the site user shall remove such material and deposit it where directed.

BASELINE ASSESSMENT OF CONDITIONS AT THE MOREHEAD CITY ODMDS

Site Designation EIS Baseline. Baseline conditions at the Morehead City ODMDS are principally reported in the site designation final environmental impact statement (EIS), Morehead City, North Carolina, Ocean Dredged Material Disposal Site Designation, January 1985. The baseline data contained in the site designation EIS was obtained solely from available scientific literature.

Information Obtained Since Site Designation. Site evaluations and monitoring since the site designation has produced supplemental information in the following areas.

Bathymetry. Bathymetric surveys have generally been conducted on portions of the ODMDS before and after each use since the site designation. These surveys have focused on the portions of the ODMDS actually used for dredged material disposal. A bathymetric survey of the Morehead City ODMDS area conducted in September/October 1995 is provided as figure 6. The bathymetric survey indicates that appreciable relict dredged material disposal mounds within the ODMDS in the northeast corner and middle of the ODMDS. The relict disposal mounds in the middle of the ODMDS are almost linear features that or oriented northwest to southeast.

Sediment Characterizations. The grain size characteristics of sediments in the vicinity of the Morehead City ODMDS were surveyed in 1979, 1984, and 1986 (USACE/EPA, 1986). These surveys indicated that the ODMDS vicinity sediments were predominantly sands with much smaller amounts of gravel, silts, and clays (table 4 and figure 7). The station-to-station variations in grain size distributions were small. The sediments in the ODMDS vicinity were very similar to the Morehead City Harbor maintenance dredged materials (tables 2 and 3).

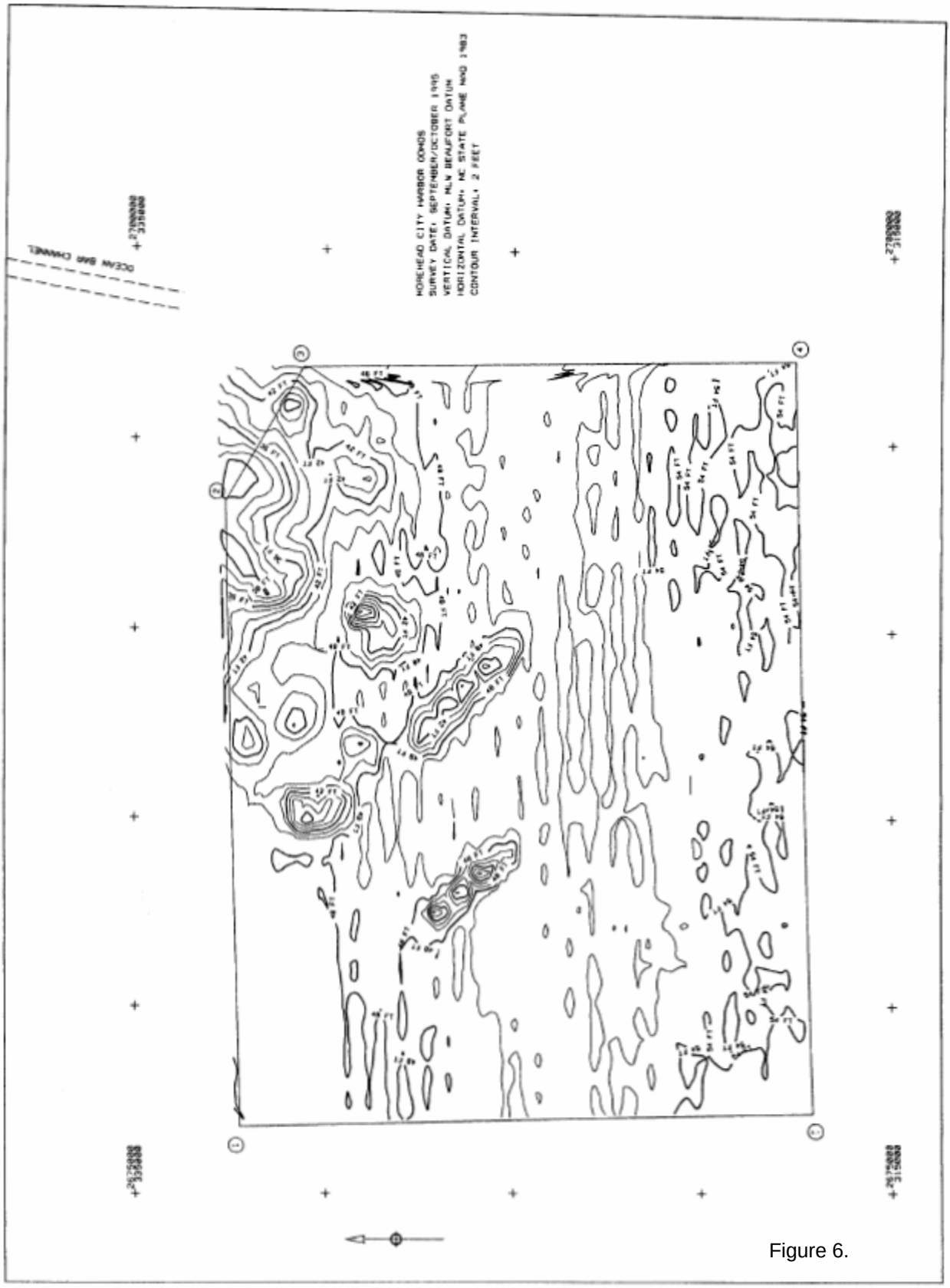

OCEAN BAR CHANNEL
MOREHEAD CITY HARBOR 00H05
SURVEY DATE: SEPTEMBER/OCTOBER 1995
VERTICAL DATUM: MLW BEAUFORT DATUM
HORIZONTAL DATUM: NC STATE PLANE NAD 1983
CONTOUR INTERVAL: 2 FEET

Figure 6.

Table 4. Grain size characteristics of sediments in the vicinity of the Morehead City ODMDS. Samples were surface grabs and taken in 1979, 1984, and 1986 as shown on Figure 7.

STATION	YEAR	% GRAVEL	%SAND	%SILT & CLAY
1. North of the Morehead City ODMDS				
MB1	**86**	**2.0**	**94.0**	**4.0**
10	**79**	**0.0**	**98.5**	**1.5**
9	**84**	**1.0**	**98.2**	**0.8**
8	**84**	**0.1**	**98.4**	**1.5**
2. South of the Morehead City ODMDS				
MA3	**86**	**1.5**	**94.5**	**4.0**
12	**84**	**0.0**	**99.2**	**0.8**
18	**84**	**0.1**	**99.5**	**0.4**
19	**84**	**1.0**	**98.6**	**0.1**
3. Within the Morehead City ODMDS				
MA1	**86**	**0.2**	**98.8**	**1.0**
MA2	**86**	**0.2**	**96.8**	**3.0**
MC1	**86**	**4.0**	**93.5**	**4.0**
1	**84**	**0.0**	**94.0**	**6.0**
2	**84**	**0.2**	**99.6**	**0.2**
3	**84**	**0.3**	**98.5**	**1.2**
4	**84**	**0.1**	**98.9**	**1.0**
5	**84**	**0.0**	**99.2**	**0.7**
6	**84**	**1.9**	**97.8**	**0.4**
7	**84**	**0.0**	**99.4**	**0.6**
4. West of the Morehead City ODMDS				
MB2	**86**	**0.0**	**97.0**	**3.0**
10	**84**	**0.6**	**97.3**	**2.1**
5. East of the Morehead City ODMDS				
14	84	**0.1**	**99.4**	**0.5**
21	84	**0.2**	**99.2**	**0.2**
13	84	**3.4**	**96.0**	**0.7**
20	84	**0.4**	**99.1**	**0.4**
12	84	**0.0**	**99.2**	**0.8**
19	84	**1.0**	**98.6**	**0.1**

Note: Gravel - grain size larger than 5.0 mm.
Sand - grain size between 0.07 and 5.0 mm.
Silt and Clay - grain size smaller than 0.07 mm.

Source: USACE - EPA, 1986.

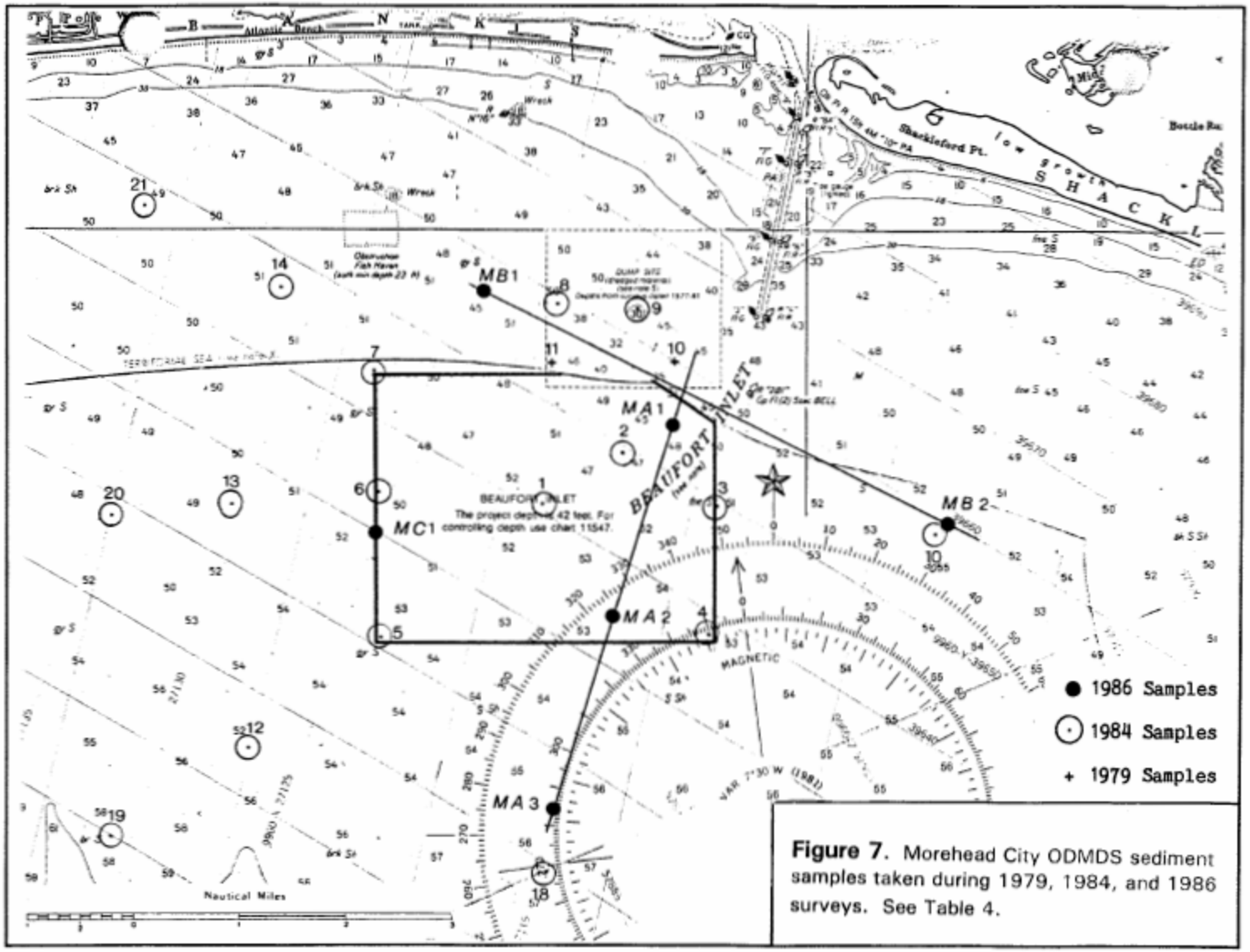


Figure 7. Morehead City ODMDS sediment samples taken during 1979, 1984, and 1986 surveys. See Table 4.

Hard bottom or reef-rock materials have not been reported in the sediment characterizations which together extend at least 0.5 nautical miles beyond the limits of the ODMDS in all directions and in some cases extend several nautical miles beyond the ODMDS limits.

Benthic Communities. Benthic communities approximately 2 miles inshore of the Morehead City ODMDS were sampled by Peterson et al. (1995) in December 1995 as a part of the nearshore placement monitoring. The stations were arranged in a grid of three transects with three stations on each transect at the 19-, 26-, and 36-foot isobaths. Taxa in order of abundance included polychaetes, annelids, bivalve molluscs, amphipod crustaceans, ecinoderms, and nematodes. The total density of infaunal invertebrates ranged from 5-14 per 76 cm^2 and total densities of larger epifaunal invertebrates ranged from 3 to 43 individuals per 10 m^2. This community of invertebrates sampled are thought to be representative of those occupying this environment over a broad geographic area.

Data on hard bottom locations in North Carolina waters (i.e., within 3 nautical miles of shore) has been collected from the scientific community, SCUBA divers and dive shops, and recreational and commercial fishermen by Moser and Taylor (1995). No hard bottoms were reported in the vicinity of the Morehead City ODMDS.

SITE MONITORING

Goals of Site Monitoring. Site monitoring is conducted to ensure the environmental integrity of an ODMDS and to verify compliance with site designation criteria, any special site management conditions, and with permit conditions or Federal authorization requirements. Monitoring should provide useful and pertinent information to support site management decisions. The main purpose of a disposal site monitoring program is to determine whether site management practices, including disposal operations need to be changed to avoid unacceptable impacts. Site monitoring is not a stand alone activity. It is based on the site designation process, the characteristics of the dredged materials, and compliance with authorized activities.

To use site monitoring as an effective tool, site managers need to define in quantitative terms the unacceptable impacts that dredged materials may have on resources of concern. Then, action levels can be set well below the effects levels defined as unacceptable and corrective measures can be taken before unacceptable effects occur. Continuous monitoring of all physical, chemical, and biological parameters and resources in and around the ocean dredged material disposal site is not necessary. A monitoring program should be structured to address specific questions (hypotheses) and measure key indicators and endpoints, particularly those defined during site designation or specific project issues that arise. A tiered

strategy for a monitoring program is desirable. With a tiered approach, an unacceptable result may trigger further and often more complex monitoring.

Morehead City ODMDS Monitoring Objectives. The objectives of the site monitoring plan for the Morehead City ODMDS are to provide information to:

- Determine if the disposal activities are occurring with compliance with site use restrictions and permit conditions;
- Provide information indicating the short- and long-term fate of dredged materials placed at the site; and
- Determine the effect of the dredged material disposal on uses of the marine environment outside of the ODMDS.

Monitoring Methods and Rationale. Monitoring strategies are proposed for the Morehead City ODMDS and thresholds for management actions are presented in table 5 and discussed in the following paragraphs. These methods will provide information to address specific and current management issues at the site including mounding and dumps occurring outside the disposal area. As indicated table 5, information obtained during monitoring may indicate the need for additional monitoring at a higher, more complex level. If more intensive monitoring is required, this monitoring plan must be revised and additional thresholds for action established.

Site Bathymetry. Within three (3) months of the completion of a disposal event, a detailed bathymetric survey of the used or active portion of the ODMDS. The active portion will be defined as a locus which is 1 nautical mile beyond the actual disposal locations up to 0.25 nautical mile beyond the site boundaries. Horizontal location of the survey lines and depth sounding points will be determined by the use of an automated positioning system utilizing either a microwave line of sight system or a differential global positioning system. Survey line spacing will be at most 250 feet. The vertical datum shall be local m.l.w. and the horizontal datum North Carolina State Plane, NAD 1983.

The survey data will be made available as a coordinate data file in a format specified by the CE and the EPA, Region IV. Predisposal and postdisposal surveys may be evaluated using surface modeling techniques. Consecutive surveys may be compared to establish apparent net direction of sediment movement. Estimates may be made of the quantities and types of materials retained within the ODMDS as compared to those dispersed offsite. The ocean disposal verification data base will be used to associate dredging project information with bathymetric features observed.

Table 5. Morehead City ODMDS Monitoring Strategies and Thresholds for Action.

STRATEGY	THRESHOLD	MANAGEMENT OPTIONS	
Monitoring Strategy	Predefined Threshold for Action	Threshold Not Exceeded	Threshold Exceeded
Site Bathymetry	Mound height > -35' m.l.w	* Continue monitoring after each disposal activity (project completion)	* Move disposal points within site * Limit quantity of material * Remove material above -25' m.l.l.w * Cease use of specific area of site * Continue monitoring mound status * Notify mariners of mound location and height
	Mound height approaching -35' m.l.w.	* Continue monitoring after each disposal activity (project completion)	* Move disposal points within site * Continue use of area but increase frequency of monitoring * Limit dredged material quantities placed at site
Disposal Site Use Records	Disposal records required by SMMP are not submitted or are incomplete	* Continue monitoring at same level	* Restrict site use until requirements are met
	Review of records indicates a dump occurred at a location other than as directed	* Continue monitoring at same level	* Dump occurred outside ODMDS boundary Notify EPA-Region IV and State of NC Investigate why egregious dump(s) occurred Remove material from egregious dump(s) if a hazzard to navigation or the environment * Dump occurred in ODMDS but not in target area Direct placement to occur as specified

Other Survey Techniques. Additional survey techniques such as side scan sonar, video records, still photography, bottom grab samples, and vertical sediment profiling will be utilized as necessary to determine the effects of disposal in the Morehead City ODMDS. The use of these techniques will be coordinated with the Wilmington District, CE and the EPA, Region IV.

Disposal Site Use Records. All dredged material disposal activities at the Morehead City ODMDS will be conducted under an approved verification plan. The CE will maintain a data base of site use. The documented site use information along with other information collected during monitoring will be used to direct future ocean disposal and monitoring activities. The data requirements were discussed previously.

Data Reporting. Data collected will be made available to interested parties to the extent feasible.

ANTICIPATED SITE USE

It is expected that use of the Morehead City ODMDS may decrease if nearshore placement and other beneficial uses of the sandy dredged materials are environmentally desirable and operationally feasible. However, there are sufficient cost and operational uncertainties regarding those uses of Morehead City Harbor navigation channel sediments that some continued use of the Morehead City ODMDS is likely. A maximum projected Morehead City ODMDS use for the next 10 years (1997 through 2006) is given in table 6. The Morehead City Harbor Federal navigation project is expected to be the sole source of dredged materials to be placed within the Morehead City ODMDS. All the anticipated dredged materials will come from maintenance dredging. No new work or channel deepening or expansion is currently anticipated.

MODIFICATION OF THE MOREHEAD CITY ODMDS SMMP

Should the results of the monitoring surveys or valid reports from other sources indicate that continued use of the ODMDS would lead to unacceptable effects, then the ODMDS management will be modified to mitigate the adverse effects. The SMMP will be reviewed and updated at least every 10 years. The SMMP will be reviewed and updated as necessary if site use changes significantly. For example, the SMMP will be reviewed if the quantity or type of dredged material placed at site changes significantly or if conditions at the site indicate a need for revision. The plan should be updated in conjunction with activities authorizing use of the site.

Table 6. Morehead City ODMDS projected site use 1996-2005. Projections based on 1970-1996 dredging records.

YEAR	PROJECT/PORTION OF PROJECT	TYPE OF WORK	DREDGING METHOD	ESITMATED QUANTITIES (MILLION CUBIC YARDS)	DISPOSAL LOCATION
1997	Morehead City Harbor Ocean Bar	Maintenance	Hopper	1.5 *	ODMDS
1998	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
1999	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2000	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2001	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2002	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2003	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2004	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2005	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS
2006	Morehead City Harbor Ocean Bar	Maintenance	Hopper	0.7	ODMDS

1997-2006 Projected TOTALS	**Maintenance**	**7.8**
	New Work	**0.0**
	TOTAL	**7.8**

Note: * Dredging in 1996 was discontinued prior to completion due to concerns for dredging impacts on sea turtles. The 1997 dredging quantity reflects an additional quantity from the previous year.

IMPLEMENTATION OF THE MOREHEAD CITY ODMDS SMMP

This plan shall be effective from date of signature for a period not to exceed 10 years. The EPA and the CE shall share responsibility for implementation of the SMMP. Site users may be required to undertake monitoring activities as a condition of their permit. The CE will be responsible for implementation of the SMMP for Federal operations and maintenance and new work projects.

REFERENCES

Moser, M.L. and T.B. Taylor. 1995. Hard Bottom Habitat in North Carolina State Waters: A Survey of Available Data. Final Report to the North Carolina of Coastal Management, Ocean Resources Taskforce. February 1995.

Peterson, C., H. Summerson, H. Lenihan, and G. Safrit, Jr. 1995. Beaufort Inlet Benthic Resources Survey, Interim Report to the U.S. Army Corps of Engineers, University of North Carolina at Chapel Hill, Institute of Marine Sciences, Morehead City N.C. August 1995.

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency (EPA). 1985. Final Environmental Impact Statement (FEIS), Morehead City, North Carolina, Ocean Dredged Material Disposal Sites Designation, January 1985.

U.S. Environmental Protection Agency (EPA). 1992. Postdisposal Areal Mapping of Sediment Chemistry at the Wilmington, North Carolina ODMDS, November 20, 1992. Prepared by Center for Applied Isotope Studies, Under EPA Purchase Order No. 2R-0926-NTSA, Submitted to US EPA, Office of Wetlands, Oceans, and Watersheds.

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency (USACE and EPA). 1986. Wilmington Harbor - Morehead City Harbor, Ocean Dredged Material Disposal Sites (ODMDS), 1986 Monitoring Survey Report, August 1986.